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THE ALBERTA Power Commission

DECEMBER 1951

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THE ALBERTA POWER COMMISSION

EDMONTON, ALBERTA

MINISTER

Honourable John L. Robinson ..... Minister of Industries and Labour

COMMISSION

Ben Russell, Edmonton, Alberta ..... Chairman

P. M. Sauder, Lethbridge, Alberta ..... Commissioner

J. E. Oberholtzer, Edmonton, Alberta ..... Commissioner

ADMINISTRATIVE OFFICERS

Vernon Pearson, Edmonton, Alberta ..... Technical Advisor

J. L. Reid, Edmonton, Alberta ..... Engineer and Secretary

EDMONTON
Printed by A. Shnitka, Queen's Printer
for Alberta, 1952.

FOREWORD

February 6, 1952.

The Honourable Dr. J. L. Robinson,
Minister of Industries and Labour,
Administration Building.
Edmonton, Alberta.

Sir :

A provision of the Power Commission Act is that : "The Commission shall annually after the end of its fiscal year, make a report to the Minister showing the revenues and expenditures **during the last fiscal year** together with a full and complete statement of the reserve funds of the Commission and an audited balance sheet of its financial transaction during the period together with such other information as the Lieutenant Governor-in-Council requires."

Such a report has been submitted from year to year but, for the reason that any information other than the financial statements have been pretty much out of date when received and therefore not of the same interest as if received a year earlier, the following amendment was made to the Power Act at the 1951 session of the Legislature :

> "The Commission shall make an annual report to the Minister covering the twelve months period ending on the thirty-first of December in each year — etc., etc."

To bring the reports of the Power Commission up to date a fairly comprehensive report has now been completed of the activities of the power Commission in co-operation with the Water Resources Department from March 24th, 1944, when the Power Act was assented to, up to December 31st, 1951.

It is my pleasure to present this report to you as information required by the Lieutenant Governor-in-Council.

The following tables, diagrams and maps are a part of this report and will be submitted to the Queen's Printer for publication.

Respectfully submitted,

BEN RUSSELL,
Chairman Power Comiission.

BR:JG.

SUMMARY

THE ALBERTA Power Commission Act was passed in 1944. This Annual Report for the year 1951 endeavours to present a factual picture of power developments in the Province of Alberta for the period up to 1944 and for the period 1944 to 1951. The Report presents the background for the Power Commission activities which started in 1944 and the subsequent development and progress made in power generation and distribution since 1944. Tables and charts show this progress pictorially.

Brief descriptions of some early reports on power development are given and it is of interest that the power generating capacity in the Province at the year 1941 is as follows:

Hydro Electric	70,868 K.W.
Commercial Steam	17,957 K.W.
Municipal Steam	50,045 K.W.
Gas and Oil Engines	4,392 K.W.
Total	143,262 K.W.

Detailed descriptions of the growth and expansion of the various power companies and the major municipally-owned power stations show a steady growth up to 1944. This steady growth and development of power generating capacity has increased to an even greater extent since the Power Commission Act was passed in 1944 and the following comparison is of interest showing capacities as of December 31st, 1944, compared with December 31st, 1951.

Future plans for power development are indicated, including the completion of the Spray River project, a proposed 30,000 K.W. unit in each of the Edmonton and Medicine Hat municipal steam plants which together with other planned projects will require capital investment of several millions of dollars.

A brief outline of the various pieces of legislation relating to power generation clearly shows the inter-dependence of water control problems and the development of electric power. The prime importance of adequate reservoirs is stressed. A description of the current Bow River problem is given in some detail . A brief resume of earlier surveys of headwater storage possibilities on the North Saskatchewan, Clear Water and Red Deer Rivers is given. This work was first done in 1921 and 1922, but the various reservoir sites have been reviewed since 1944 in the light of present day trend of expansion and construction and with a better knowledge of existing and future power requirements together with more recent data as to stream flow and topography.

Water Power investigations conducted since 1944 are listed in some detail. These include particularly studies of the Bow River drainage basin and the Athabasca drainage basin. These studies conducted directly under the supervision of the Power Commission are

	December 31, 1944	December 31, 1951
Power generating capacity (water power) K.W.	67,886	163,975
Power generating capacity (other sources) K.W.	97,364	140,789
Total Power generating capacity K.W.	165,250	304,764
Annual production (water power) K.W. hrs.	322,015,000	501,597,877
Annual production (other sources) K.W. hrs.	233,019,000	578,592,591
Total annual production K.W. hrs.	555,034,000	1,080,190,468

The above table indicates an almost doubling in the generating capacity and annual productions in that seven-year period.

essential in any plans for complete development of possible hydro sites in the Province.

The extension of electricity to rural farm areas has been steadily pressed forward in the past five years. Some 13,000 connections have now been made which number corresponds very closely to the original plans and estimates made in 1944. The Power Commission survey indicates a continuation of this programme adding several thousand farms each year for the next several years.

A report was prepared at the request of the Alberta Petroleum and Natural Gas Conservation Board estimating the requirements of natural gas for power generation up to the year 1960. An estimate of 20 billion cubic feet of gas per year was made based on past and present usage and estimated power growth.

In the Power Commission Act of 1944 the powers and duties of the Commission were described, some of which are briefly as follows :

First — To investigate the existing facilities for the manufacture and distribution of power in Alberta including water power, coal, gas and other sources.

Second — When so authorized by the Lieutenant Governor-in-Council, to manufacture, distribute and sell such power or acquire by purchase, lease or otherwise, without the consent of the owner, the whole or any part of any undertaking of any person, firm or corporation. To manufacture or distribute power in Alberta or contract with any person or municipality to furnish a supply of power to the Commission.

To date the Commission has confined its activities to the first, maintaining a watching brief on the progress and development of the Power picture as worked out by the various private and municipally-owned companies. An examination of this report in detail, particularly the progress made since 1944, would appear to indicate that a satisfactory programme of development is being carried out.

EVENTS LEADING TO POWER COMMISSION ACT

In the year 1923 many Alberta citizens were of the opinion that Government operation of power generating facilities under similar arrangements to those in Ontario should be investigated. Consequently arrangements were completed in 1924 between the Premier of Alberta and the Chairman of the Ontario Hydro Electric Commission for a survey and report to determine the probable consumption of electrical energy and the economical power sites which might be developed in Alberta.

As a result of experiments by Calgary Power Limited and Canadian Utilities Limited to determine the economic feasibility of farm electrification at Olds and Swalwell respectively, numerous petitions by farm groups in the Province were presented to the Alberta Government requesting some comprehensive government assisted plan of farm electrification for Alberta. Consequently the Alberta Research Council was instructed by the Alberta Government to investigate and report with respect to such a plan.

Report of Hydro-Electric Commission of Ontario:

From the surveys made by the Commission it was reported that there is no doubt whatever that, in order that the maximum amount of power available on the Bow River and its tributaries may be developed and operated in the best interests of the Province, they should be under the control and operation of one central organization. These developments are each complements of the others and the characteristics of the sources of water supply makes water storage of first consideration.

In preparing that part of its report dealing with cost estimates the inclusion of the larger loads and power centres, only, was considered. In this case it was determined that the plan was quite feasible and economically self supporting. The report indicates that the frame work for a province-wide scheme might be so commenced and then added to, from time to time, as load conditions warrant such extensions. The following is from the report by the Commission:

> "Based on the information that we have obtained the Commission is of the opinion that the power resources of the Province of Alberta should in the main be developed and operated as one single unit whether this is done by private interests or through some agency of the Government itself. In this way only can the power resources of the Province of Alberta be developed and operated in the best interests of the people."

Since the date of this report, Calgary Power Limited has been largely responsible for the development and operation of the water power resources. These have been developed along the lines recommended in the report.

Rural Electrification in Alberta by Andrew Stewart:

Mainly to determine some feasible plan of rural electrification for Alberta Andrew Stewart, for the Alberta Research Council, prepared a very comprehensive report which was submitted to the Alberta Government in March, 1944. The following is from this report:

> "Sources of power do not limit the undertaking of desirable developments. The Province of Alberta is generously endowed with power resources in water, coal, gas and oil."

> "Transmission lines traverse most of the established area and more densely settled areas indicating that a large pro-

portion of farms in the Province could be served off existing transmission lines."

"The main reason for the lag in electrification of farms with central station power are (a) small individual users, (b) high distribution costs, and (c) relatively low and variable cash incomes of farm families."

Having in mind some limitation of the scope of any immediate programme of farm electrification Mr. Stewart, in his report, reviews the progress in rural electrification already achieved or anticipated elsewhere, the assumption being that comparable progress could be attained in Alberta provided the assumption was valid under conditions in the Province. The following is from Mr. Stewart's report:

"Fairly rapid extension of farm electrification occurred in some Canadian provinces and in some Western States in the period immediately before the war. This trend appears to be associated with two principal factors: (a) substantial reductions in the costs of construction and operation, and (b) an increased disposition to consider the electrification of farms as a desirable public service, and to promote the extension of farm electrification by providing a significant measure of assistance."

In approaching the problem of farm electrification for Alberta, Mr. Stewart concludes as follows:

"If conditions in Alberta were substantially similar to those elsewhere, electrification of 30% of the farms in the Province over a period of ten years would be an accomplishment fully commensurate with achievements elsewhere. Such a programme would involve the electrification of 30,000 farms at an average rate of 3,000 per year."

"If the average consumption for farms connected for one year was 300 k.w. hrs. and if the annual increase in consumption amounted to 100 k.w. hrs. then the average consumption over the entire system would be 750 k.w. hrs. per year at the end of ten years. With 30,000 farms connected, total annual consumption would amount to 22,500,000 k.w. hrs."

"The evidence clearly suggests that farm people want electricity primarily for domestic uses. Having in mind the existing lack of convenience in the farm homes that is a laudable objective. However, domestic uses do not immediately increase farm incomes, nor is it possible to support rural electrification where power is used only for lighting and a few household appliances. These considerations again emphasize the importance of farm income and a vigorous program of load building."

The conclusions from Andrew Stewart's surveys have been the basis for rural electrification or farm electrification planning in Alberta since 1944 when the Alberta Power Commission was provided for.

The following tables are from Andrew Stewart's report and show: (a) hydro-electric plants in Alberta prior to 1944; (b) list of fuel-burning plants in Alberta as at the year 1944; (c) the power generating capacity as at the year 1944; and (d) type of plants and annual generation during the year 1941.

Hydro Electric Power Plants Prior to Year 1944:

Location	Owner of Plant	Horsepower Capacity
Cascade, Anthracite	Calgary Power Company	23,000
Kananaskis, Seebe	Calgary Power Company	12,000
Horseshoe, Ozada	Calgary Power Company	20,000
Ghost, Ghost River	Calgary Power Company	36,000
Lake Louise Creek	Canadian Pacific Railway	800
Bow River, Bassano	Canadian Pacific Railway	180
Cascade, Bankhead	Dominion Government	960
Elbow, near Calgary	City of Calgary	1,065
Bow River, Calgary	Calgary Water Power Company	780
Blindman, Blackfalds	Town of Lacombe	200
Prairie Creek, Strachan	G. L. Gaber & Son	12
		94,997

NOTE: — As pointed out in the report, the smaller stations are either no longer in existence or inaccessible for electrification. The existing hydro generating facilities are substantially those of the Calgary Power Company Limited.

The following, from the report, is a list of fuel-burning plants:

Edmonton	45,500 H.P.
Lethbridge	14,000 H.P.
Medicine Hat	7,240 H.P.
Drumheller	8,000 H.P.
Grande Prairie	1,300 H.P.
Peace River, Athabaska, McLennan	600 H.P.

The following table from the report is of interest to show the power generating capacity in the Province as at the year 1941:

Hydro Electric	94,997 H.P.
Commercial Steam	24,071 H.P.
Municipal Steam	67,085 H.P.
Gas and Oil Engines	5,887 H.P.
Total	192,040 H.P.

The following table, from the report, is of interest to show type of plants and the annual power generation in the Province as for the year 1941:

Type of Generating Plant	No. of Plants	Total K.w. Hrs. Generated	Average K.w. Hr. Generated per Plant
Commercial Hydro	4	178,980,000	44,745,000
Commercial Fuel	58	15,515,000	267,500
Municipal Fuel	10	124,819,000	12,481,900
All Plants	72	319,743,000	4,440,900

During the years 1921 and 1922 the Dominion Reclamation Service carried out fairly extensive surveys for headwater storage possibilities of the North Saskatchewan, Clearwater and Red Deer Rivers. Headwater storage will ultimately be required on all Alberta streams for flood protection and for irrigation and water-power development.

Reservoir sites investigated by Dominion Reclamation prior to the year 1944:

Name	Approx. Location of Dam Sites W. of 5th Mer.	Date	Height of Dam	Flooded Area in Acres	Capacity in Ac. Ft.
Douglas Lake	Sec. 7, Tp. 30, Rg. 14	Oct., 1922	110	1,458	64,500
Red Deer River No. 1	Sec. 16, Tp. 31, Rg. 14	Oct., 1922	110	545	21,000
Red Deer No. 2	Sec. 6, Tp. 32, Rg. 12	Nov., 1922	195	2,192	142,500
Red Deer River No. 4	Sec. 18, Tp. 31, Rg. 10	Nov., 1922	134	1,490	67,000
Burnstick Lake	Sec. 7, Tp. 35, Rg. 6	Aug., Sept. & Oct.,1922	39	1,804	40,360
Stony Creek	Sec. 29, Tp. 34, Rg. 6	Aug., 1922	---	---	---
Stony Creek	Sec. 29, Tp. 34, Rg. 6	May & July, 1923	61	2,600	39,870
The Gap, Clearwater	Sec. 2, Tp. 35, Rg. 10	June & Oct., 1923	148	3,800	157,202
The Gap, North Saskatchewan	Sec. 3, Tp. 40, Rg. 14	Aug., 1923	170	4,575	368,000
James River	Sec. 7, Tp. 34, Rg. 6	Aug. & Nov., 1922	108	1,226	48,652
Raven-Red Deer	Sec. 22, Tp. 35, Rg. 3	May, Aug. & Sept., 1923	78	8,000	152,000
Swan Lake	Sec. 25, Tp. 36, Rg. 9	June, 1923	35	950	19,300
Clearwater Cutoff	Sec. 18, Tp. 35, Rg. 11	July, 1923	165	2,200	99,350

Reservoir Sites — Continued.

Name	Approx. Location of Dam Sites W. of 5th Mer.	Date	Height of Dam	Flooded Area in Acres	Capacity in Ac. Ft.
Lower Clearwater Lake	Sec. 5, Tp. 33, Rg. 15	July, 1923	124	900	36,400
Shunda Creek	Sec. 6, Tp. 41, Rg. 14	Sept., 1923	70	4,140	100,000
Coral Creek	Sec. 9, Tp. 37, Rg. 18	Sept., 1923	60	846	15,700
White Goat River	Sec. 4, Tp. 37, Rg. 19	Aug., 1923	60	4,760	136,000
Cataract Creek	Sec. 5, Tp. 37, Rg. 20	Aug., 1923	100	1,810	64,600
North Saskatchewan	Siffleur — Not Feasible.				
Whirlpool, North Saskatchewan	Sec. 14, Tp. 35, Rg. 18	Aug., 1923	140	6,820	368,300
Glacier Lake	Sec. 19, Tp. 34, Rg. 20	Sept., 1923	70	1,410	75,000
North Fork, North Saskatchewan	Sec. 8, Tp. 35, Rg. 20	Sept., 1923	100	2,871	126,000
Mistaya River	Sec. 29, Tp. 33, Rg. 19	Aug., 1923	100	2,440	137,000
Falls Creek	Sec. 25, Tp. 37, Rg. 12	Oct., 1923	50	295	9,430
North Fork, Ram River	Sec. 14, Tp. 37, Rg. 6	Oct., 1923	100	3,050	174,000
South Fork, Ram River	Sec. 28, Tp. 35, Rg. 14	Oct., 1923	50	3,364	91,100

NOTE :—The above listed reservoir sites have been reviewed since 1944 in the light of the present-day trend of expansion and construction and with a better knowledge of existing and future power requirements together with more recent data as to stream flow and topography.

UTILITIES OPERATING IN ALBERTA PRIOR TO YEAR 1944

A number of private companies and corporations generated and distributed electrical energy in Alberta prior to the year 1944 when the Alberta Power Commission was appointed of which Calgary Power Company Limited, Canadian Utilities Limited and the cities of Edmonton, Lethbridge and Medicine Hat were the main producers.

Calgary Power Limited :

The Calgary Power Company Limited, now the Calgary Power Limited, was organized in the year 1909. Prior to this there were two rival interests in Alberta holding power rights.

The Royal Securities Corporation brought these two together and procured for the new company a contract for the newly organized Canada Cement Company governing power for the Calgary and Exshaw Cement mills. This new Company, the Calgary Power Company Limited, having acquired properties and rights, brought its first hydro-electric plant at Horseshoe Falls on the Bow River some fifty miles west of Calgary into operation in May, 1911.

In the following year the company completed a storage reservoir at Lake Minnewanka some thirty miles upstream and, early in 1913, commenced construction on the Kananaskis Falls site some two miles above the Horseshoe Falls plant.

Upon the completion of the Bow River plants the company made rapid growth. The system load which in the year 1922 was about 4,000,000 kilowatt hours increased steadily until in the year 1927 it was about 78,000,000 kilowatt hours and the load increased in 1928 to over 100,000,000 kilowatt hours. This load not only over-taxed the water-power plants but necessitated drawing heavily on steam power furnished by the Calgary Municipal Steam Plant, thus making it imperative for the company to extend its generating facilities to provide for some 175,000,000 k.w. hrs., which was anticipated for the year 1930.

Upon the consummation of satisfactory arrangements between the Province of Alberta and the City of Calgary, the company was authorized, under provisions of the Dominion Water Power Regulations, to proceed with the construction of the Ghost-Radnor development consisting of a dam, reservoir and power station at the Radnor site some four miles below the Ghost site. The Ghost site was

developed by the year 1929, but the Radnor site has not yet been developed.

During the ten years following the development of the Ghost site power requirements in the Province not only did not increase but actually dropped off prior to the second world war. However, by the year 1940 a further plant on the Bow River was required for the purpose of supplying power to an explosive plant to be constructed at Calgary. The company therefore was granted the right to enlarge the Lake Minnewanka reservoir and to construct the Cascade power station. Rights were also granted to the company to enlarge the reservoir at the Upper Kananaskis Lake which had been constructed in the year 1932. Along with this development a number of transmission lines were constructed for the purpose of tying the new plants in with the existing system.

The tables on pages 8 and 9 of this report give the locations and capacities of plants operated by the Calgary Power Company Limited as at December 31st, 1944. In addition to these the company acquired and operated the steam plant at Calgary with a capacity of 10,000 k.w.'s. By agreement, the company exchanged electrical energy with the cities of Edmonton and Lethbridge produced by the steam plants at these points. At that date the load carried by the systems could be summarized as follows:

	K.w. Hrs.
Annual load Calgary Power Company Ltd.	385,000,000
Annual load Calgary Power Company Ltd. System	515,000,000
	K.w.
Peak load Calgary Power Company Ltd.	73,500
Peak load Calgary Power Company Ltd. System	104,000

The following financial statement approved by the Alberta Provincial Auditor shows the actual cost of the works of the company as at December 31st, 1944.

The costs shown include engineering, interest during construction, taxes and insurance, contractors' profit, purchase of equipment, roads, railways, clearing or other essential works undertaken and carried out solely in the construction of the developments or works and not independently profitable. Such a statement is required to be filed under the provision of Section 36 of the Water Power Regulations.

Fixation of Construction Costs:

Ghost Development	$ 5,358,833.68
Horseshoe Development	1,688,087.24
Kananaskis Development	1,272,651.37
Minnewanka-Cascade Development	2,926,275.02
Ghost Diversion	32,835.72
Interlakes Pocaterra Development	673,167.34
Transmission & distribution lines	10,422,035.85
Saskatchewan costs	23,319.94
Work in progress	124,611.62
Cost of promoting the enterprise	383,355.00
Cost of providing capital	2,355,336.79
Balance to accord with property account and deferred charges	623,153.81
	$25,883,663.38

Canadian Utilities Limited:

This company was incorporated, under Dominion Charter, as The Mid-West Utilities Limited on May 18th, 1927, and was for the purpose of constructing and operating central electric generating plants and for the distribution of the power generated thereby to the surrounding communities, many of which were poorly served by small local generating plants. On June 12th, 1928, the name of the company was changed to Canadian Utilities Limited and, as of the first of that year, its parent company, the International Utilities Corporation, acquired the assets of the Union Power Company Limited which served the Drumheller coal area.

In 1927 franchises for the generation and distribution of electrical energy were acquired from the Municipalities of Vegreville and Lloydminster, in Alberta, and Kindersly in Saskatchewan. Plans for transmission lines to connect these municipalities and to serve the adjoining communities were then commenced.

The company in 1928 commenced operations of its plant at Grande Prairie and the

construction of transmission lines from the plants to the surrounding communities.

Franchises were also acquired by the company that year for the Municipalities of Castor, Coronation and Stettler in Alberta and for Wilkie and Yorkton in Saskatchewan. Some twenty-five additional franchises were also acquired for some twenty-five smaller towns and villages and the construction of transmission lines to serve the communities in the districts were under construction.

During the depression years which followed, expansion was not so rapid as during the earlier years. However, by 1944, when the Power Commission Act was passed by the Legislature, the fixed assets of the company had grown to some $7,000,000.

Dominion Electric Power Limited:

This company with headquarters in Estevan, Saskatchewan, operated the following power stations in Alberta prior to the year 1944.

Location	Generating Capacity-K.w.	Generation in the year 1944 in K.w. Hrs.
Peace River	540	approx. 380,000
McLennan	484	" 225,000
Athabaska	270	" 265,000
Jasper	335	" 400,000

The company was serving 1,900 customers in the year 1944.

NOTE:—The Alberta plants have been taken over by Northland Utilities a new company organized for the purpose.

City of Edmonton Municipal Power Station:

The first power plant in Edmonton was built by a private company, the Edmonton Electric Light Company. This plant was erected on the river bank near the Low Level Bridge. The plant was taken over by the City in 1902. Construction on the present site began in 1907. Building and rebuilding has continued on this site to the present time.

The first modern boiler of 450 pounds pressure was installed in 1931. The 15,000 k.w. turbine was installed in 1939, and the second one went into operation in 1943.

City of Lethbridge Municipal Power Station:

A previous power plant belonging to the Lethbridge Electric Light Company was purchased by the City of Lethbridge in September, 1908. Construction of the present plant, in the Riverbottom area, was started almost immediately. On New Years' Eve, 1909, the old plant was burned to the ground, but fortunately work on the present plant was sufficiently near completion so that one steam engine driven unit of 400 k.w. was connected up temporarily and placed in service by the middle of January, 1910. During the intervening period, power was purchased from one of the coal mines in the district.

In November of 1910 a 580 k.w. steam engine driven generator was installed, and early in 1911 two additional boilers were installed. The plant's electrical generating capacity was then 980 k.w., with generation at 2,300 volts, two phase.

In 1912 four 250 H.P. boilers were installed, together with a 1,500 k.w. steam turbine driven generator.

In 1918 a 1,500 k.w. turbine alternator was ordered from the C.G.E. Co. This unit was installed in June, 1919, and remained in service until 1939.

In 1924 the plant was changed from 2 to 3 phase and the G.E. generator was rewound. Other units utilized auto transformers to convert to three phase.

In 1931 a 3,750 K.V.A. turbo-alternator generating at 13,200 volts was purchased from the Oerlikon Co. of Switzerland. At the same time two 30,000 pound per hour Stirling boilers were installed.

In March of 1942 a 70,000 pound per hour Babcock-Wilcox and Goldie-McCullough Co. coal fired boiled was installed, and in May, 1943, a C. A. Parsons Company 5,500 turbo-alternator, was installed.

City of Medicine Hat Municipal Power Station :

The initial plant was brought into operation in November, 1913, with an initial installation of 1,500 K.V.A. in two 750 K.V.A. steam turbo generators, with steam supplied from four 4,000 sq. foot water tube boilers at 160 p.s.i.g. Natural gas at 980 b.t.u. per c.f. was used as fuel. The project was designated as a combined and integrated Power and Water Plant, and included filtration and pumping facilities with a capacity of 6 m.m. g.p.d., ultimate.

In 1915 an additional turbo generator of 1,500 K.V.A. was added to complete the ultimate designed capacity of the project, and in 1921 an additional 5,000 sq. ft. water tube boiler was installed in a temporary annex to the main building. No further additions to plant were made until 1929, when, due to increase in maximum system demand, an extension to plant was completed involving one 3,750 K.V.A. turbo generator, with steam supplied from existing boilers.

Other Power Stations in the Province :

Some additional twenty-five small private, government and munipally owned plants operated in Alberta as at the year 1945 with a total generating capacity of some 20,000 k.w., of which the East Kootenay Sentinal plant with 10,000 k.w. is half the total.

Legislation :

The following Acts of the Alberta Legislature have to do with the construction of power stations and the generation and distribution of electrical energy :

The Alberta Power Commission Act.
The Water Resources Act and Water Power Regulations.
The Public Utilities Act.
The Co-operative Marketing Association Guarantee Act.
The Electric Power Taxation Act.
The Municipal Districts Act.
The Electrical Protection Act.

The Power Commission Act assented to by the Alberta Legislature, March 24th, 1944, provides for a Commission styled the Alberta Power Commission. The Act prescribes the powers and duties of the Commission, some of which are briefly as follows :

First :—To investigate the existing facilities for the manufacture and distribution of power in Alberta including water power, coal, gas and other sources.

Second : — When authorized by the Lieutenant Governor-in-Council to manufacture, distribute and sell such power or acquire by purchase, lease or otherwise, without the consent of the owner, the whole or any part of an undertaking of any person, firm or corporation. To manufacture or distribute power in Alberta or contract with any person or municipality to furnish a supply of power to the Commission.

To date the Commission has confined its activities to the first. The Lieutenant Governor-in-Council has so far not seen the necessity of authorizing the second.

Section 66 of the Water Resources Act provides as follows :

> "Until the Lieutenant Governor-in-Council makes regulations under the provisions of this Act the water power regulations established under the Dominion Water Power Act by an Order-in-Council dated October 31, 1921, published in the Canada Gazette of November 12, 1921, and as amended as to Section 48 (31) and 83 (A) by Order-in-Council of September 10th, 1928, published in the Canada Gazette of September 1, 1928, shall mutatis mutandis apply for administration of provincial water powers and such lands as may be required in the development, operation and use thereof, "The Minister" being substituted for the "Minister of the Interior" the "Supreme Court of Canada" substituted for the "Exchequer Court of Canada", "Provincial lands" being substituted for "lands of the Dominion", "The Water Resources Act" and "Provincial Water Powers" being subsituted for the "Dominion Water Powers" respectively."

The general plan of the Act and Regulations is to provide that the water powers on public and Crown lands, essential to development or protection of such water powers, are to remain vested in the Crown, no outright sale

of them being permitted; the right to develop the water power being granted by license to any approved applicant for a definite term of years upon certain specified conditions.

The Water Power Act is intended to provide means for exercising an effective measure of control over, not merely the development itself, but also over all the auxiliary works necessary for storing and using the waters and for transmitting the power, as well as the construction of the works and the management of the property. The undertaking authorized by license under this Act may thus extend far beyond the limits of the Crown lands on which the water power is situated and include more than the physical structure and property; and the right of the constituted authorities to control all the essential operations of the licensee is fully established by the Act whether these operations are conducted wholly on Crown lands or partly also on privately-owned lands. This in fact, was one of the main purposes of the Act, namely to establish a statutory authority with the right to control not only the power site, but all the lands, works, and operations necessary for developing and using power.

The other Acts listed contain provisions pertaining to the distribution of electrical energy. They will be found in the revised Statutes of Alberta.

ACTIVITIES OF THE ALBERTA POWER COMMISSION

Prior to the transfer of control of water resources from the Dominion to the Province, water power surveys were made of the Bow, Red Deer, North Saskatchewan, Athabaska and Peace Rivers, and some of the tributaries. Power companies interested in the development of water power had made further investigations. The Calgary Power Limited had made more detailed surveys of the Bow River and had constructed a number of power stations and reservoirs. In more recent years the Power Commission in co-operation with the Department of Water Resources is investigating the existing and potential water-power facilities in Alberta for incorporation into a comprehensive system of power development for Alberta.

Table I, attached, gives a list of the existing power stations in the Province together with the annual production from the year 1948 to date. Graph I shows the Calgary Power Limited annual loads and system load for the year 1928 to 1951 inclusive and also the yearly peak loads carried.

The following comparison is of interest to indicate the progress of power development in Alberta since 1944 :

	December 31, 1944	December 31, 1951
Power generating capacity (water power) K.w.	67,886	163,975
Power generating capacity (other sources) K.w.	97,364	140,789
Total Power generating capacity K.w.	165,250	304,764
Annual production (water power) K.w. hrs.	322,015,000	501,597,877
Annual production (other sources) K.w. hrs.	233,019,000	578,592,591
Total Annual production K.w. hrs.	555,034,000	1,080,190,468

The following from the graph showing Calgary Power loads is of interest to show the load characteristics .

	December 31, 1944	December 31, 1951
Average rate of load increase per year in K.w. hrs.	50,000,000	100,000,000

NOTE:—As in the year 1950 there were 946,375,583 K.w. hrs. generated, an increase of 77,867,359 K.w. hrs. over 1949. This represents an increase of slightly over 8% for 1950. The average increase would be over 10% per year.

Increase in Power Generating Facilities Since Year 1944 :

Extensions have been made since the year 1944 to the following five existing power stations :

Edmonton Municipal Steam Plant.
Medicine Hat Municipal Steam Plant.
Northland Utilities Limited Plants.
Canadian Utilities Limited Plants.
Calgary Power Limited Plants.

The total capacity of these extensions is approximately 62,000 k.w. In addition to this some twelve new power stations have been brought into operation with a total generating capacity of approximately 77,800 k.w.

Edmonton Municipal Steam Plant Extension :

It is proposed to install a further additional 30,000 k.w. unit in this plant in 1952 and gradually change over from coal to natural gas.

Medicine Hat Municipal Steam Plant Extension :

A major extension is now being made to this plant by the City of Medicine Hat and the Calgary Power Limited which will increase the generating capacity by 30,000 k.w. This plant will be tied in with the system of the Calgary Power Limited and electrical energy exchanged between the City and the company.

Northland Utilities Extensions :

This company is considering the development of a small water power plant on the Heart River made possible by the reservoir created at Winagami Lake by the Department of Water Resources. It is probable that some further small plants using natural gas for fuel will also be installed.

Canadian Utilities Limited Extensions :

To provide an adequate supply of water for cooling purposes, this company is constructing a dam on the Vermilion River adjacent to its plant at that point. The company along with Northland Utilities is considering the development of water power on the Heart River and at Cold Lake end is also investigating the possibilities of a steam plant at Wabamun.

The Barrier Power and Storage Development :

Calgary Power Limited was authorized by License dated October 5th, 1949, to develop the Barrier water power site on the Kananaskis River in Sec. 10-24-8-W. 4th Meridian. The works consist of an earth fill dam to raise the water level to a maximum elevation of 4,515 mean sea level datum ; a concrete sluiceway and intake structure in the earth fill, a steel penstock to conduct the water to a power station located at the toe of the dam and a tail race excavated in the bed of the Kananaskis River.

The following are the essential features of the development :

Height of dam, 140 feet; effective head, 151 feet, rating; 13,000 k.w., crest length 2,318 feet; gross capacity of reservoir, 35,962 acre feet; net capacity of reservoir, 20,000 acre feet.

The construction cost as fixed by the company and approved by the Alberta Provincial Auditor under Section 36 of the Water Power regulations is as follows :

Supervision	$	23,062.62
Turbines, engines and auxiliary equipment		93,403.27
Generators, exciters and auxiliary equipment		145,060.05
Switching, metering and control equipment		44,934.99
Head ponds, reservoirs, dams		1,276,350.97
Headworks, water conduits, tail-race		297,821.91
Structures and land improvement		145,801.96
Miscellaneous equipment		16,736.02
Undisturbed construction expense		32,593.37
Engineering surveying		128,077.60
Interest during construction		98,032.63
Substation		58,079.83
		$2,359,955.22
Transmission line		46,538.11
		$2,406,493.33

The Spray Development:

The Spray River is one of the main tributaries of the Bow River. It rises in the area south and beyond the Three Sisters range and is fed by the snows and glaciers along the Continental Divide between Mt. Assiniboine and the Palliser Pass. It flows northward to meet the waters from Upper and Lower Spray Lakes which are immediately south of Three Sisters Mountains, thence northwesterly through the Spray canyon and Spray valley until it finally joins the Bow River at Banff.

The main dam located on the Spray River by raising the water 165 feet creates a reservoir in the Spray Lakes valley which covers 4,800 acres of land. The reservoir has a capacity of 190,000 acre feet which will not only be used in the Spray plants, but will be used to supplement winter flows at existing and future plants on the Bow River below Canmore. This dam backs up the Spray River over Spray Lakes. In order to contain the water a dam has been constructed in the Goat Valley. This dam is 1,980 feet long and 48 feet high. Directly below the dam is located the Three Sisters power station which controls the flow of water from the Spray reservoir.

The water from the Three Sisters plant is carried by a system of level canals and dykes down Goat valley and through Whiteman's Pass to the intake of the pressure tunnel high above Chinaman's Peak. Above Canmore this tunnel is 2,200 feet long and drops water 905 feet to the Spray power plant located at the foot of Chinaman's Peak. This tunnel was lined with cement at the upper end, the lower 500 feet being lined with steel.

The main plant, the Spray, is located at the lower end of the tunnel under a head of 905 feet. The water from Spray plant is carried by a canal to a point close to the Bow River west of Canmore where it again drops down 325 feet through a penstock to the Rundle plant on the Bow River.

The three power plants of the development have a combined output capacity of 88,600 H.P. The Three Sisters plant operates under a maximum head of sixty feet and consists of 3,600 H.P. propeller-type turbine with a 4,000 K.V.A. generator.

The main equipment of the Spray plant consists of a 62,000 H.P. Francis-type turbine operating at 450 r.p.m. under a head of 905 feet. This is directly connected to a vertical generator of 47,500 k.w. capacity.

Rundle plant operates under a head of 325 feet, its 23,000 H.P. Francis-type turbine turning a 20,000 K.V.A. generator at 300 r.p.m.

The Auditor's report has not yet been completed with respect to this development, but the construction cost as at September 30th, 1951, was as follows:

Storage development	$ 4,453,889.79
Three Sisters Power Station	853,608.50
Spray Power Development	5,554,913.53
Rundle Power Development	2,028,734.08
Engineering and contingencies	95,151.60
Total	$12,986,297.50

In order to fully utilize all of the flow created by the Spray development it was necessary to enlarge the Kanaskis Falls power station by 9,000 k.w.

The station has been furnished with the necessary equipment to operate the Spray, Three Sisters, Rundle and Barrier power stations automatically.

Other Smaller Plants:

The remainder of the stations listed, a total of some 12,000 k.w., although insignificant as units they, however, do in the aggregate take care of a considerable portion of the increasing power load.

WATER POWER INVESTIGATIONS

Attached to this report is a list of potential hydro power sites which have been investigated in Alberta since 1944. The table gives the locations, heads and estimated capacities, and other information available. However, the capacities of all of these sites will depend upon the headwater storage which will ultimately be developed to regulate the streams.

The seasonal flow of all Alberta streams is very variable, the ratio of summer to winter flow being about six to one. For this reason reservoirs in which to store the large quantities of summer flow for use in the winter are required in order to develop any considerable amount of firm power. The capacities estimated in Table 2 are on the assumption that headwater storage will ultimately be built.

The plan attached to this report of the Bow River Drainage Basin shows the existing and potential reservoirs in the basin. The following reservoirs have been developed for power purposes.

The important potential power and reservoir sites on the main stream are the Bearspaw, Glenbow, Radnor, Russell, Lac Des Arcs and Shepherd developments.

There are also a number of potential developments on the Kananaskis River such as the development of storage at the Lower Kananaskis Lake and a power development below the falls near Pocaterra Creek. These have all been investigated to some extent by the Calgary Power Limited, but aerial surveys have been completed by the Power Commission in recent years.

With respect to the potential power sites and reservoirs in the North Saskatchewan River Drainage Basin which have been investigated by the Power Commission, the following are of importance :

Carvel Site, Rocky Rapids Site, Gap Site, Tershishner Site, Whirpool Site, Nordegg Site, Cardinal River Site, Clearwater and Clearwater-Gap Site,

as well as a number of other miscellaneous sites along in the headwaters.

Name	Location	Capacity Acre-feet
Ghost	Tp 13, Rg. 5, W. 5th Mer.	73,000
Interlakes	Tp. 19, Rg. 5, W. 5th Mer.	100,000
Lake Minnewanka	Tp. 26, Rgs. 11 & 12, W. 5th Mer.	180,000
Barrier	Tp. 24, Rg. 8, W. 5th Mer.	15,000
Spray Lake	Spray River	160,000

In the Red Deer Drainage Basin the following are the important sites under investigation :

Name of Site	Location of Dam Site	Capacity in Acre-feet
Red Deer River at Ardley	Sec. 32, Tp. 38, Rg. 23, W. 4th Mer.	370,000
Red Deer-Raven Site	Sec. 22, Tp. 35, Rg. 3, W. 5th Mer.	152,000
Douglas Lake Site	Sec. 7, Tp. 30, Rg. 14, W. 5th Mer.	64,000
Red Deer Site No. 1	Sec. 6, Tp. 32, Rg. 12, W. 5th Mer.	142,500
Red Deer Site No. 2	Sec. 16, Tp. 31, Rg. 14, W. 5th Mer.	21,000

The above listed sites are of more value for irrigation that for power development. These could be constructed and operated jointly for irrigation and power if designated and built for that purpose.

The reservoirs investigated in the Athabaska drainage basin are of particular importance.

The Athabaska River rises on the east slope of the Rocky Mountains in Township 36, Range 25, West 5th Meridian and flows in a north-easterly direction for almost 1,000 miles to Lake Athabaska. The drainage basin forms the most southerly portion of the Mackenzie River drainage basin. The character of the basin is very similar to the Peace, Smoky and other mountain streams. From the foothills to Lake Athabaska the basin consists of a series of muskegs and uplands well timbered with spruce and pine. Large lakes in the upper reaches tend to regulate the flow. Spring floods, therefore, are not so prominent as for most mountain and foothill streams. However, like the Peace River, flood conditions usually occur in the months of July and August as a result of prolonged hot spells in the mountains.

There are natural storage sites at the head of the Athabaska River and a number of good dam sites on the river below. This stream has for some time been considered to offer excellent opportunities for the development of a comprehensive water power undertaking consisting of a connected system of reservoirs and power stations similar to the system now in operation along the Bow River above Calgary. The particular sites investigated are :

(1) Image Rock Power Site.
(2) Gooseneck Power Site.
(3) Wild Hay River Storage Power Site.
(4) Maligne Lake Site.
(5) Astoria Site.
(6) Rocky River Site.

The following main streams with their tributaries contribute to the Athabaska River :

Macleod River.
Pembina River.
Lesser Slave River.
Clearwater River.

The drainage area at Entrance is 3,915 square miles and average annual run off 4,825,000 acre feet or 1,232 acre feet per square mile. The drainage area at Athabaska is 29,642 square miles and average annual run off 10,600,000 acre feet or 358 acre feet per square mile. The drainage area at the mouth is estimated to be 59,480 square miles and the average annual run off 16,908,700 acre feet or 284 acre feet per square mile.

To complete the early investigations of the Athabaska River a canoe party made a further reconnaissance of the section of the river between Hinton and Grand Rapids and particularly that stretch through Townships 66 and 67, Ranges 22 and 23, which consists of a big loop to the south through the town of Athabaska. This section of the river comes within eighty miles of Edmonton. Recent aerial photos indicate that there is a possible dam site within the loop referred to but it is not known yet whether or not foundation conditions are suitable for a high dam.

The flow of the Athabaska River, like all mountain streams becomes comparatively low in the winter and therefore, storage is necessary in order to develop any considerable amount of power. At Athabaska for instance, the maximum discharge was on June 10th, 1944, about 108,640 cubic feet per second, while the minimum flow was 1,660 cubic feet per second on February 13th, 1923.

Because there are natural reservoir sites at the head of the Athabaska River, including Lesser Slave Lake, and a number of fair dam sites below, including Pellican and Grand Rapids, this stream offers excellent opportunities for a comprehensive power development similar to that in operation on the Bow River.

Lesser Slave Lake at the head of the Lesser Slave River provides very economical storage with which to boost the winter flow. This reservoir alone would increase the winter flow from 1,660 c.f.s. to about 7,500 c.f.s., or equivalent to about 680 continuous horsepower per foot of head.

The Wild Hay is a proposed high head development similar to the Spray development on the Bow River. It is possible to create considerable storage by backing the Wild Hay River into a long depression which comes fairly close to the Athabaska River about five miles above Entrance. At this location a head of

from 500 to 600 feet might be developed between the proposed reservoir and the Athabaska River. To supplement the water supply of the Wild Hay River it will probably be necessary to divert Snake Indian Creek to the Hay River. Storage created here would not only be available to a number of power stations within the power reach thus created, but also over the proposed dams such as could be constructed at Image Rock, Gooseneck, Pelican and Grand Rapids, and other sites on the Athabaska River.

Plans of Utility Companies:

Having regard to the increasing cost of construction and the heavy drain on the limited supply of labor, it was realized in 1949, by the various utility companies supplying electrical energy in Alberta and by the Power Commission, that in order to provide service to new industries long range planning and the fullest co-operation between companies was necessary in order to make the best possible use of the existing facilities. With this in view the utility companies in Alberta embarked on expansion programmes to meet the growing power demands.

The Spray development was planned by the Calgary Power consisting of a reservoir in the Spray valley and the following new power stations:

Three Sisters Power Station	3,600 H.P.
Spray Power Station	62,000 H.P.
Rundle Power Station	23,000 H.P.
Kananaskis Falls Power Station (extension)	12,000 H.P.

These have since been completed and are now in operation.

Estimating the available water supply from the Spray River, average per year, as 160,000 ac. ft. or 80,000 c.f.s. days, then the energy available from these plants will be approximately 176,728,300 k.w. hours per annum. However, this same water over the Horseshoe Falls and Ghost plants will develop an additional supply of some 23,558,800 k.w. hours or 18.6 per cent of the total production in the Province for the year 1951.

The Calgary Power Limited plans also included the following extensions or improvements to transmission lines:

Between Bow River plants and Calgary and between Red Deer and Nordegg; and from Camrose to Hardisty.

Between Spray Development and Barrier Development, from the Bow Valley plants to Crowsnest Pass from Edmonton via Fort Saskatchewan, Redwater and Clive to Calder, from Edmonton to Leduc, from the Bow River plants to Edmonton, from the Crowsnest Pass via Lethbridge to Calgary, from Wetaskiwin to Camrose, from Brooks to Medicine Hat, from Nordegg to a proposed Brazeau Power Station and from the proposed Brazeau Development to the Cadomin-Mountain Park area.

With the exception of some of the latter extensions these have either been completed or are under construction.

With respect to Rural Electrification, Calgary Power Limited planned as follows:

Year	Farms to be Electrified	Cumulative
March 31st, 1948	4,000	4,000
March 31st, 1949	2,500	6,500
March 31st, 1950	3,000	9,500
March 31st, 1951	3,000	12,500
March 31st, 1952	3,000	15,500
March 31st, 1953	3,000	18,500

The following is a summary showing the progress up to October 31st, 1951:

Isolated connections	1,368
Experimental groups	2,053
Co-operative associations	6,594

In addition to this some 2,146 connections have been surveyed and are under construction of which 1,000 will be completed by March 31st, 1952, bringing the total to 11,015 as against the 12,500 planned.

Plans of the Canadian Utilities Limited included the installation of a 6,000 k.w. unit at its Drumheller plant and improvement of its water supply system for the Vermilion plant for the generation up to a capacity of 8,000 k.w. and also the installation of an additional 1,200 H.P. unit at the Grande Prairie plant to bring the

capacity to 3,370 H.P. or approximately 2,500 k.w. These installations have either been completed or are under construction.

The following transmission lines were also planned :

From Grande Prairie to Rycroft, Sexsmith and Wanham, from Derwent through Myrnam and Beauvallon to Two Hills, from Drumheller to Carbon, from Hanna to Castor, from Bonnyville to Cold Lake, from Hanna to Youngstown, from St. Paul through Vilna and Bellis to Smoky Lake and from Elk Point to serve the Salt company to Lindberg and Heinsberg.

The following transmission lines were constructed in 1951 :

69 K.V. line, Drumheller to Hanna	40	miles
69 K.V. line, Castor to Halkirk	14	"
22 K.V. line, Smoky Lake to Vilna	30	"
22 K.V. line, Lloydminster to Paradise Valley	31	"
22 K.V. line, Sexsmith to Rycroft	30	"

Conversion of 22 K.V. line to 34 K.V., Vegreville to Vermilion, 60 miles.

With respect to Rural Electrification, Canadian Utilities Limited planned for the following expenditures to increase the 1,500 customers then connected by 1,000 farms a year as follows :

1949	$1,000,000
1950	600,000
1951	500,000
1952	500,000
1953	300,000
1954	600,000

As at November 1st, 1951, the company had actuall connected 2,500 farms as against 3,500 planned.

The Northland Utilities, a comparatively new company in the Province, has provided excellent service to outlying districts principally to the north of the Province. Since taking over from the Dominion Electric Company, it has added 450 k.w. unit to the Jasper plant and constructed a small water-power development as well at this location. The company has increased its customers by 3,900 in the past six years.

The company is planning an early expansion of its generating facilities at Peace River and McLennan either by natural gas or water power and by natural gas at Fairview.

With respect to Rural Electrification, the company has at present 205 customers.

The general picture to date then with respect to Rural Electrification is that out of the 13,000 planned for the Province by the end of 1951 some 13,479 connections have been made. However, this progress if continued will be an accomplishment fully commensurate with achievement elsewhere if Andrew Stewart's estimate for 30,000 connections in ten years can be considered reasonable progress for Alberta.

SURVEYS OF POTENTIAL SERVICE AREA

The Potential Service Area as designated by Andrew Stewart is outlined on the map attached to this report.

Within this area surveys were made by the Power Commission in the years 1944 and 1945 to determine the number of farms which might be connected to the transmission lines within the area.

The method adopted was to visit all farms in the townships of the area; to sketch the location of buildings with reference to the section line and make notes of all features which would have any bearing on an over-all estimate of the economical connections possible.

Attached to this report, Table (3), is a sample of the information, compiled by townships, of the area surveyed.

This information together with accompanying maps has been very useful to farmers and the utility companies for the purpose of organizing associations under the provisions of the appropriate Acts of the Province.

As a result of the surveys made, the Power Commission prepared a five-year programme which appeared to be reasonable for Alberta, the purpose being to determine the cost of connecting farms as follows:

First year	1,000
Second year	2,000
Third year	3,000
Fourth year	3,000
Fifth year	3,000
Total	12,000

It was assumed:

First: — That materials and labour were available in quantities such that construction work would not be impeded.

Second: — That a low figure for the first year with increments in the third year would be required in order to develop an effective organization.

Cost estimates based on unit construction costs prevailing in 1945 indicated as follows:

Material costs, line construction	$ 4,500,000
Labour costs, line construction	1,500,000
Total	$ 6,000,000
Material costs, wiring buildings	$ 1,740,000
Labour costs, wiring buildings	960,000
Total	$ 2,700,000
Appliances expenditures	$ 2,538,400

THE BOW RIVER PROBLEM

Water power undertakings on the Bow River, because of the low winter flow, are faced with the necessity of storing summer water for use in the winter, whereas irrigation requires water during the summer months. The possibility of a conflict of interests between the two types of development therefore exists. The problem is to determine to what extent each should be allowed to develop and in what order of priority.

A series of low flow years began in 1936 and, records obtained since that time, have considerably modified any figures upon which previous conclusions might have been based. The average flow of the Bow River at Calgary based on the stream flow records from 1911 to 1935 inclusive is 2,528,596 acre feet. The average at the same point for the years 1936 to 1946 inclusive is 1,927,827 acre feet.

Based on early records it was considered that the water supply of the Bow River was adequate for an almost unlimited irrigation and power development. The following development of irrigation was contemplated :

	Acres.
Western Section Canadian Pacific Railway Company	219,000
Eastern Section Canadian Pacific Railway Company	375,000
Canada Land and Irrigation Company	200,000
Champion Irrigation District	50,000
Total	844,000

Unfortunately for the companies which undertook the construction of some of these projects, but fortunately for those responsible for the administration of the water resources, those irrigable areas have, due to a number of reasons, been greatly reduced and are now limited as follows :

	Acres.
Western Irrigation District	50,000
Eastern Irrigation District	281,000
Bow River Project (C.L. & I. Extension)	240,000
Total	571,000

To determine what the situation would be in low water years such as occurred in 1940 and 1941, a very comprehensive water supply study was made of the Bow River in order to determine the affect of developing storage at Spray Lakes.

The following assumptions were made :

Name of Project.	Irr. Acres.	Percent. Loss	Annual Reqt. Ac. ft. per Ac.	Canal Reqt.
Western Irrigation District	50,000	30	1.5	800 c.f.s.
E.I.D. direct flow	181,000	40	1.5	3,000 c.f.s.
E.I.D. under storage	100,000	40	1.5	----------
Bow River project	240,000	40	1.5	----------

NOTE : — With respect to peak requirements it was assumed that 181,000 acres in the Eastern Irrigation District and 50,000 acres in the Western Irrigation District, these will have to be met directly from the river which in the case of 100,000 acres in the Eastern Irrigation District and 240,000 acres in the Bow River Project the peak requirement can be met wholly or largely from reservoirs.

It was determined that the effect of operating the Bow River for Power development, including the Spray development, does not aggravate the irrigation difficulties but rather, by increasing the flow of the stream in April, September and October, increases the natural flow of the stream due to the release of water from the power reservoirs during these months.

However, it is recognized that irrigation requirements have priority over requirements for power purposes and that, for the development planned, the water supply study indicated that in low water years such as 1940 and 1941 the regulated flow of the Bow River was considerably below the peak requirement indicated. For this reason the following

provision was made in the license issued for the Spray Development.

> "If so required by the Minister the Company shall, however, during any period or periods of not more than ten days in the aggregate in the months of June and July of any year when the rate of flow of the Bow River, immediately below the Ghost plant, is less than 4,600 c.f.s. release from the Ghost reservoir such water as is required by the Minister and can be beneficially used, under irrigation rights granted prior to this agreement, sufficient to bring the flow immediately below the Ghost plant to 4,600 c.f.s., but the total amount of water so released from storage during any year shall never exceed 20,000 acre feet."

It is considered that 4,600 c.f.s. supplemented by the Elbow and Highwood Rivers is sufficient to meet the peak requirements of those lands directly dependent on the Bow River.

However, it may be necessary ultimately, in order to meet the peak requirements of the irrigation projects, to create additional storage preferably of Lac Des Arcs where both irrigation and water power requirements can be provided for.

Although ice jams along the Bow River at Calgary are known to have occurred long before the Ghost dam was ever constructed, and it would be difficult to prove that the operation of the river for power is the sole cause of any particular jam, most people are convinced that the following two causes are largely responsible for the annual ice jams that now occur at Calgary.

First : — The average increase in winter flow of the Bow River due to the release of stored water for power development.

Second : — The fluctuation of the winter flow at the Ghost plant in unison with the demand for electrical energy from the plant.

To what degree each of these causes is responsible is unknown, but together they contribute to the frequent winter floods which now take place along the river.

Subject to certain provisions set out in an agreement dated May 6th, 1949, between Alberta and Calgary Power Limited for the development of storage and water power in the Spray River, the following provision is included :

> "As soon as additional generating capacity is made available from the initial development under the license for the Spray Site and until the Bearspaw or other site between the Ghost Site and the City of Calgary is developed or until the dam hereinafter referred to is constructed at Bearspaw, the Company during the period each year that the ice pack in the Bow River is building up through the City of Calgary will, if so required by the Minister, operate the Ghost plant on a reasonably steady load, except in cases of break down of equipment or other emergencies in its system, and for that purpose will conform to and carry out any orders of the Minister as to the amount of water to be released from time to time from the Ghost dam during any such period ; provided, however, that such orders shall not be made by the Minister unless in his opinion the surface flooding in the City of Calgary arising from ice conditions has not been sufficiently alleviated by the hereinbefore recited protective dyking or otherwise and unless also in the Minister's opinion such orders are necessary and will be effective in remedying such surface flooding in the City of Calgary arising from ice conditions."

The agreement commits the company upon the completion of the initial development of the Spray, to commence construction of the Bearspaw development or some substitute provided the Minister considers that the system of protective dyking has not sufficiently alleviated surface flooding at Calgary. If, as and when in the opinion of the Minister :

> (a) "the Company's load approaches the point where the output of the Spray and all other plants of the Company is fully absorbed by the requirements of its system and there is no other substantial surplus of competitive power available for sale or in process of development by other parties so that a further hydro-electric development is necessary", and
>
> (b) "the benefits arising from the alleviation of ice trouble in the City of Calgary by the construction of the Bears-

paw plant or a dam would be great enough and sufficiently assured to warrant the relatively high cost of such construction."

The Province agrees that upon the completion of the Bearspaw dam or power development the company shall be relieved from operating the Ghost plant on a reasonably steady load.

Reservation of Natural Gas for Power Generation:

At the request of the Alberta Petroleum and Natural Gas Conservation Board, the Alberta Power Commission made an estimate of natural gas reservations which should be made for the generation of power as at the year 1960. For these estimates the following main factors were considered:

First: — The present and future power requirements for Alberta.

Second: — The trends of production of electrical energy within Alberta.

Third: — Some consideration of hydro-electric generation within Alberta.

With respect to the present and future requirements the following records of the Power Commission were considered:

Year	Production	Annual Increment
	K.w. hrs.	K.w. hrs.
1945	556,240,917	
1946	559,328,668	33,087,751
1947	673,879,992	74,551,324
1948	762,115,536	88,235,544
1949	868,508,224	106,392,688

The rate of increase shown for the next eleven years would indicate a total load of as much as 1,855.5 million K.w. hours as at 1960.

With respect to production trends it was estimated that there was a limitation to the amount of electrical energy that could be generated economically from water power and it was, therefore, considered advisable to reserve 20 billion cubic feet of gas per annum to take care of one billion K.w. hours that would be required by 1960 in addition to 155.5 million K.w. hours which might be produced from water power, coal and Diesel plants.

The following is from the submission made by the Power Commission:

"It should be noted that the foregoing estimate is limited to a period of approximately ten years. This is for the reason that it is not possible to intelligently predict beyond such period. Any estimate covering a larger period than this, say fifty years, would be, to say the least, highly conjectural."

Use of Military Transmission Lines for Rural Electrification:

During the last war airports and military camps in Alberta were connected to the transmission systems in the Province; at the termination of the war most of the airports and camps were closed so that the lines were of no further value for the purpose intended.

In some cases these lines also served individuals or communities so that the disposal of them became a problem.

To prevent the removal of such lines that might be useful, arrangements were made for inspections by the Power Commission.

Most of the lines have since been incorporated into a system of rural electrification for the respective areas.

Individual Power Plants:

As at the year 1944 some 5,000 individual power plants were in operation in the Province, most of which were within the Potential Service Area.

It has been found that the farmers who have these small plants are the most anxious to get connected up with central station power because of the larger use that may be made of electrical energy and the limitations of the smaller plants.

Some of the better individual plants, where central power has been substituted, have been procured by farmers outside the Potential Service Area, but in most cases it has been found that the batteries and other equipment are in such condition that it would be more economical for those who require the small plants to buy new equipment better suited to their requirements.

WATER POWER INCIDENTAL TO IRRIGATION DEVELOPMENT

Every dam constructed for the diversion of water for irrigation purposes creates the head for the generation of power, and at every location where it is necessary to drop water in canals from a higher to a lower elevation is a potential source of power.

To divert the Red Deer River for lands in the William Pearce Irrigation project a dam on the Red Deer River is required.

To carry water from the St. Mary dam to the lower lands of the St. Mary and Milk Rivers Development, it is necessary at considerable cost to drop the water some 450 feet.

In the case of the Red Deer River diversion, the power possibilities have been investigated from time to time for various plans of development but until the extent of the irrigable tracts and their locations are definitely determined, it will not be possible to intelligently assess the power potentialities of the project.

A quantity of 300 cu. ft. per second for minimum flow will be required to be released from the Ardley reservoir. This over 165 feet, the effective head, would create some 4,500 continuous horse power or equivalent to 29.6 million killowat hours average per year. This at 50 per cent load factor, made possible by the pondage available, would warrant an installation of some 10,000 H.P.

This would be of considerable value if tied into the present power system.

As the project is now designed however, it is proposed to irrigate, by gravity, some 300,000 acres and by pumping from canals and reservoirs an additional 200,000 acres. To irrigate this area it is proposed to divert 850,000 acre feet from the Red Deer River and an additional 330,000 acre feet from the Clearwater River, making a total of 1,180,000 acre feet, part of which will be used on the lands and the balance to meet the riparian requirements below, and incidentally the power requirements with which to pump to the lands above the canals.

An average quantity per year of something like 293,000 acre feet is proposed in order to meet the power requirements and the balance, 887,000 acre feet per year, to meet the irrigation requirements.

For a considerable number of years or, until the project is fairly well settled, most of the 30,000,000 k.w. hours generated at the Ardley dam could be used commercially, but ultimately will be required to pump water to the higher lands, unless or until, therefore, an additional supply of water is ultimately diverted from the Clearwater and North Saskatchewan Rivers, it would not be safe to construct or contract for the power temporarily available. It would not be economical to divert water from the Clearwater and North Saskatchewan Rivers solely for the development of an additional output of power. If and when these diversions are required to supplement the flow of the South Saskatchewan River however, it would then be economical to increase greatly the power output of the Ardley development.

In other words, there are good possibilities for the development of power in connection with the diversion of water from the North Saskatchewan, Clearwater and Red Deer Rivers for irrigation purposes, but until the quantities of water to be diverted are more definitely known, and the possible power heads determined, it is not possible to assess intelligently the power possibilities of the development.

In connection with the construction of canals for the St. Mary and Milk Rivers Development it has been necessary to construct a number of expensive drop structures. It is proposed to make use of these drops to develop power either for the purpose of pumping water to the higher lands or sell to the Calgary Power Company for distribution throughout its system.

The following is from the report of the St. Mary and Milk Rivers Water Development Committee dated 1942:

"Some of the irrigable lands east of Fortymile Coulee are above the elevation of the main canal in this area and can only be served by means of pumping to raise the water to a high level canal. To provide the necessary power of pumping, it is proposed to utilize drops to be constructed in the main canal between the St. Mary River and Chin Coulee.

"Low cost power stations installed at these drops will, in addition to supplying the necessary power to pump a supply of water to higher levels, generate power for sale by the transfer of water during the winter from the St. Mary reservoir to the Chin Coulee reservoir."

"If the operation of these canals during the winter is feasible, it is estimated the 9,390 continuous horse power can be developed for five months during the winter at an operating cost of $50,000, which if disposed of at one-half cent per k.w. hour will provide a net revenue each year of $70,000. This revenue if applied to the operation and maintenance of the project will amount to fifteen cents per acre."

TABLE No. 1

Power Stations in Operation and Energy Generated for the Years 1948 to 1951.

Power Stations or Systems.	Generating Capacity—K.W.	1948	1949	1950	1951
Calgary Power Limited:					
Ghost Plant	28,000	143,863,600	131,611,200	119,396,200	164,756,000
Kananaskis Falls Plant	19,000	71,453,800	63,060,000	60,039,200	89,867,200
Horseshoe Falls Plant	14,000	75,672,900	68,942,700	66,936,600	86,778,400
Cascade Plant	18,500	96,857,800	65,209,100	53,389,900	64,963,100
Barrier Plant	13,500	41,909,400	33,404,400	39,528,100	51,614,300
Spray Plant	50,000				35,591,300
Three Sisters Plant	3,000				1,859,100
Rundle Plant	17,000				3,605,500
City of Calgary Steam Plant—Victoria Park	10,000	23,270,200	43,245,400	57,252,500	31,848,200
Wainwright		58,310	37,330		
Calgary Power Limited—Net Generation	173,000	453,086,010	405,510,130	396,542,500	530,883,100
City of Edmonton —Net Generation	60,000	188,691,200	267,431,300	308,449,400	302,329,700
City of Lethbridge —Net Generation	8,875	29,350,970	40,533,568	41,867,450	36,015,390
City of Medicine Hat Fuel Plant	13,400	30,386,500	30,730,347	32,803,926	36,861,822
East Kootenay Power Sentinal Plant	10,000	24,630,700	41,547,490	40,146,830	45,617,220
Lake Louise Water Power Plant	375	695,000	584,100	551,000	569,000
Banff Springs Hotel	625	887,000	649,800	666,000	663,300
Town of Edson	514		1,016,613	1,059,695	1,205,707
Suffield Experimental Station, Ralston	1,100			1,355,420	1,520,800
Winfield	27			42,709	
Spirit River (Now operated by Canadian Utilities)				275,000	
Edgerton (Now operated by Calgary Power)				87,256	
Vilna (Now operated by Canadian Utilities)				49,835	
Luscar Coals Limited	1,918			3,091,280	3,774,200
Canadian Salt Co. Ltd., Lindbergh	220			1,069,350	1,033,550
Mountain Park Coals Limited (abandoned and dismantled June, 1950)			3,960,000		
University of Alberta	800			2,414,930	2,586,500
Whitecourt	150				248,610
McMurray	50				117,012
Embarras	70				110,000
Canadian Sugar Factories:					
Raymond	1,500			2,860,560	2,860,560
Picture Butte	1,250			2,200,000	2,200,000
Taber	2,000			4,270,000	4,270,000

Power Stations or Systems.	Generating Capacity—K.W.	1948	1949	1950	1951
Provincial Government Power Plants:					
Parliament Buildings and Administration, Edmonton	350		1,031,840	724,860	684,980
Institute of Technology, Calgary	150		174,600	206,200	219,400
Ponoka Mental Hospital	695		1,619,600	1,893,250	1,771,250
Fort Saskatchewan Gaol	115		338,270	362,460	365,975
Lethbridge Gaol	75		114,875	120,270	127,916
Oliver Mental Institute	1,100		1,319,200	1,473,200	1,410,600
Central Alberta Sanatorium, Calgary	155		416,320	455,470	475,250
Provincial Training School, Red Deer	25		80,465	170,070	116,005
Northland Utilities Limited:					
Athabaska	406	464,334	460,598	614,909	674,555
Chauvin—Calgary Power (Nov. 20, 1951)	137	118,214	134,170	121,551	172,651
Mayerthorpe	300	123,890	235,869	367,610	462,059
McLennan	480	635,206	843,024	1,091,152	1,237,926
Peace River	890	981,026	1,196,096	1,517,994	2,455,148
Fairview	187	297,823	392,804	548,734	397,572
High Prairie	330	267,488	338,148	528,820	591,539
Jasper	1,027	860,480	1,069,215	1,657,963	2,185,297
Onoway	40		9,514	83,140	99,900
Wildwood	75			38,619	98,181
Lac la Biche	115			45,000	261,858
Manning	110				125,541
Canadian Utilities Limited:					
Rycroft (7 month estimate for 1951)	135	119,053	150,345	200,882	168,267
Youngstown	235	98,442	165,832	445,352	534,614
Grande Prairie	1,995	3,111,427	3,754,890	4,320,904	4,898,664
Vegreville		318,239	19,928,301		
Drumheller	11,500	22,441,467	41,035,225	59,004,186	54,976,281
Bonnyville		236,974	243,970		
Vermilion	8,000	3,310,263	477,786	28,657,200	31,071,740
Fort St. John	225		13,919	553,789	677,407
Cold Lake	65			247,346	62,821
Other small plants—estimated		1,000,000	1,000,000	1,000,000	1,000,000
	304.791	762,115,536	868,508,224	946,375,583	1,080,189,868

TABLE No. 2

List of Water Power and Reservoir Sites in Alberta Under Survey and Investigation Since Year 1944.

Drainage Basin	Name	Location	Power Head (feet)	Pondage (acre feet)	Capacity (Continuous H.P.)
Bow River	Bearspaw Site	Sec. 6-25-2-5	50 to 75	approx. 20,000	10,450 to 15,700
" "	Glenbow Site	Sec. 28-25-3-5	approx. 100	" 25,000	20,900
" "	Radnor Site	Sec. 15-26-5-5	" 64	" 7,000	13,400
" "	Russell Site	On I.R. at Morley	" 140	" 50,000	29,300
" "	Lac des Arcs Site	Sec 23-24-9-5	" 65	500,000	11,800
" "	W.I.D. (Shepard) Site	Intake 13-24-1-5 P.H. 24-21-27-4	300	32,000	68,000
" "	Bow Lake Site	31-18-5	Storage	27,411	
" "	Hector Lake Site	30-17-5	Storage		
" "	Inter Lakes Site			100,000	
North Sask. River	Carvel Site	Sec. 30-50-2-2	100	" 400,000	20,000
" " "	Rocky Rapids Site	Sec. 33-47-7-5	130	" 300,000	20,000
" " "	Gap Site	Sec. 36-39-14-4	170 to 320	300,000 to 1,800,000	10,000 to 50,000
" " "	Tershishner Site	Sec. 3-38-17-5	180	200,000	10,000
" " "	Whirlpool Site	36-17-5	120	250,000	8,000
" " "	Alexo Site	40-13-5	70	20,000	7,000
" " "	Waterfowl and Glacier Lakes		Storage	75,000	
" " "	Nordegg River Site		80	44,000	4,000
" " "	Cardinal River Site	Sec. 21-45-18-5	280	75,000	8,000
" " "	Clearwater Gap Site	Sec. 2-35-10-5	130	200,000	
Red Deer River	Ardley Site	Sec. 32-38-23-4		370,000	
" " "	Raven River Site	Sec. 22-35-3-5		152,000	
" " "	Douglas Lake Site	Sec. 7-30-14-5		64,500	
" " "	Red Deer No. 1 Site	Sec. 6-32-12-5		142,500	
" " "	Red Deer No. 2 Site	Sec. 16-31-14-5		21,000	
Athabaska River	Image Rock Site	58-5-5	130	250,000	20,000
" "	Goose Neck Site	53-22-5	170	250,000	18,000
" "	Wild Hay Site	53-26-5	550	270,000	30,000 to 60,000
" "	Brule and Jasper Lakes	Tps. 47-48-49-50, R. 27-5.	Storage limited by proximity to C.N.R.		
" "	Maligne Lake Site	Tps. 42-43, R. 24-25-26, W. 5th	Storage	150,000	
" "	Astoria River	8 miles South of Jasper	470	None at present	600
" "	Rocky River	45-24-5			
" "	Pelican Rapids Site	79-17-4			
" "	Town of Athabaska	Sec. 19-22-66-4	100	180,000	30,000
" "	Grand Rapids	85-17-4			

NOTE :—There are also five possible sites located between the Junction of the Brazeau River and Rocky Mountain House with a total estimated head of 500 feet.

TABLE No. 3

FARM ELECTRIFICATION SURVEY

Tp. 20	Rge. 14	W. of 4	Meridian
Tp. Near	BROOKS		

Good Prospects	39	Good	28%
Fair Prospects	37	Fair	27%
Poor Prospects	63	Poor	45%
Owner Farms	110	Owned	79%
Tenant Farms	29	Tenant	21%
Total Farm Pop.	523	Average Farm Pop.	3.8
Average No. Acres per Farm	263	Worked per Farm	198
Proportion of Land Improved	75%		
Total Cattle	3,282	Average	26
Total Horses	—	Average	—
Total Hogs	6,921	Average	49
Total Chickens	—	Average	—
Proportion of Farms with wells	4.3%	Average Depth	85 ft.
Power for Pumping	2	Percentage	1%
Grain Chopped per Farm	2,662	Bu. Chopped by own tractor	79%
Other means	on Farm 1%		Off the Farm 20%
Proportion Having Cars	60%	Tractors 74%	Telephones 10%

Type of House					
	Frame	143	Stucco 0	Other	0
	Percentage	100	Percentage 0	Percentage	0

Rooms per House	4.7				
Condition of House:	Good	26%	Fair	28%	Poor 46%
Condition of Barn:	Good	26%	Fair	26%	Poor 48%
Area per Barn	840 Sq. Ft.		Other Buildings per Farm		3.7
Distance House to Barn	193 ft.		To Water		82 ft.

TABLE No. 4
Progress and Cost Data.

	Experimental Area Hookups	Hamlets Served By Farm Lines	Hamlet Services As At Left	Commercial Served by Farm Lines	Isolated Farm Hookups	1949	1950	1951
Farm Electric Services	2,053	60	1,199	592	1,368			
Canadian Utilities	860	5	74	60	164			
Northland Utilities	-			3	162			
Total Farm Hookups						3,760	10,528	13,605

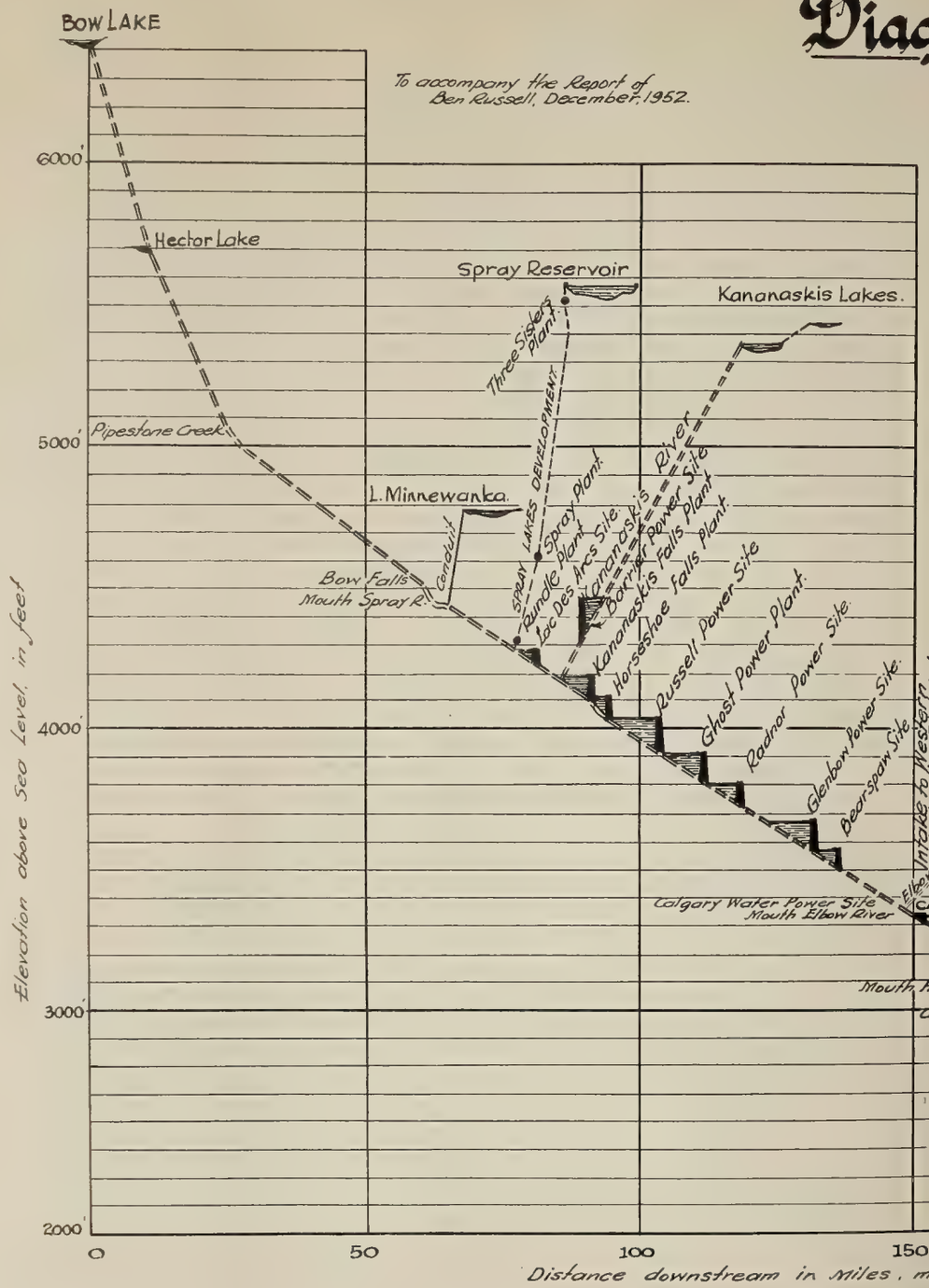
	Est. Cost	Guarantee	Owing Sept. 30/51	Members	Isolated Farm Hookups	Experimental Area—Farms	R. E. A. Members Served Oct. 31/51
1948	$ 469,882.00	$ 150,967.60	$ 63,246.90	635			
1949	2,394,355.07	761,180.38	405,530.76	2,558			
1950	2,533,408.01	1,055,731.31	865,271.06	2,625			
1951	2,709,915.36	1,225,593.06	558,666.10	2,631			
No Guarantee	459,629.00			549			
Calgary Power					1,368	2,053	6,594
Canadian Utilities					164	860	1,501
Northland Utilities					162		37
Total	$8,567,189.44	$3,193,472.35	$1,892,714.82	8,998	1,694	2,913	8,132

	Non-Farm Hookups	Hamlets Served By Farm Lines	Hamlet Services	Total Farm Hookups, Oct. 31/51	Surveyed Under Construction	Total R. E. A. Members To Be Serviced, 1951
1948						
1949				3,760		
1950				10,528		
1951				13,605 Est.		
No Guarantee						
Calgary Power	400	41	1,199		2,146	8,740
Canadian Utilities	60	5	74		224	1,725
Northland Utilities	3				61	98
Total	463	46	1,273		2,431	10,563

Diagrammatic Profile of Bow River

Showing Existing, and proposed, Power Sites and other diversions.

Scale: Hor. 1 inch = 20 miles. Vert. 1 inch = 400 feet.



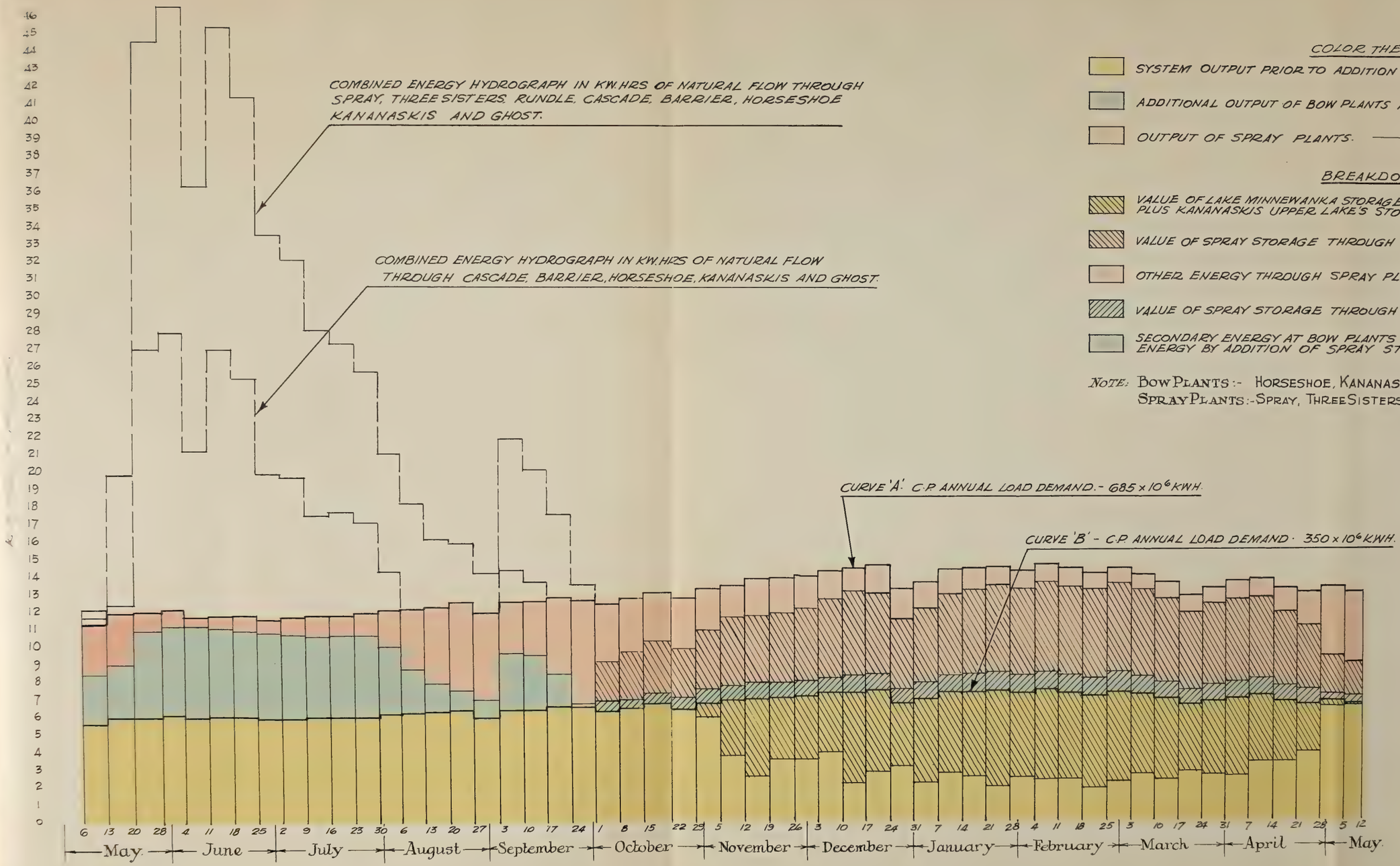
BARRIER POWER SITE (In operation) 13,500 H.P.	Headwater El.	4515.
	Tailwater	4364
	HEAD	151'
LAC DES ARCS SITE (Proposed)	Headwater El.	4285
	Tailwater	4220
	HEAD	65'
KANANASKIS PLANT (In operation) 18,500 H.P	Headwater El.	4200
	Tailwater	4126
	HEAD	74'
HORSESHOE FALLS PLANT (In operation) 22,000 H.P.	Headwater El.	4126
	Tailwater	4051
	HEAD	75'
RUSSELL POWER SITE (Proposed).	Headwater El.	4050
	Tailwater	3910
	HEAD	140'

GHOST POWER SITE (In operation) 37,450 H.P.	Headwater. El.	3910.
	Tailwater	3805.
	Head.	105'.
RADNOR POWER SITE (Proposed.)	Headwater. El.	3805.
	Tailwater	3741
	Head.	64'.
GLENBOW SITE. (Proposed)	Headwater. El.	3672
	Tailwater	3572
	Head.	100'.
BEARSPAW SITE. (Proposed).	Headwater. El.	3578
	Tailwater	3528
	Head.	44'.

SPRAY LAKES DEVELOPMENT.

THREE SISTERS 3600 H.P.	Headwater El.	5583.0
	Head.	63 ft.
SPRAY PLANT. 62,000 H.P.	Headwater El.	5520.0
	Head.	905 ft.
RUNDLE PLANT. 23,000 H.P.	Headwater El.	4615.0
	Head.	325 ft.

REVISED FEB. 1952. A.E.M. 1928.



COLOR THEME:

SYSTEM OUTPUT PRIOR TO ADDITION OF SPRAY STORAGE AND PLANTS.

ADDITIONAL OUTPUT OF BOW PLANTS AFTER INTRODUCTION OF SPRAY STORAGE &

OUTPUT OF SPRAY PLANTS. ——

BREAKDOWN:

VALUE OF LAKE MINNEWANKA STORAGE THROUGH CASCADE AND BOW PLANTS PLUS KANANASKIS UPPER LAKES STORAGE THROUGH BARRIER & BOW PLANTS.

VALUE OF SPRAY STORAGE THROUGH SPRAY PLANTS.

OTHER ENERGY THROUGH SPRAY PLANTS.

VALUE OF SPRAY STORAGE THROUGH BOW PLANTS.

SECONDARY ENERGY AT BOW PLANTS FIRMED UP INTO PRIMARY ENERGY BY ADDITION OF SPRAY STORAGE AND PLANTS

NOTE: BOW PLANTS:- HORSESHOE, KANANASKIS AND GHOST.
SPRAY PLANTS:-SPRAY, THREE SISTERS AND RUNDLE.

Calgary Power

K.W.H. VALUE OF SPRA
IN CALGARY POW

DEC. 1, 1951.

COLOR THEME:

SYSTEM OUTPUT PRIOR TO ADDITION OF SPRAY STORAGE AND PLANTS.	350 × 10^6 KW. HRS
ADDITIONAL OUTPUT OF BOW PLANTS AFTER INTRODUCTION OF SPRAY STORAGE & PLANTS	100 × 10^6 KW. HRS
OUTPUT OF SPRAY PLANTS.	235 × 10^6 KW. HRS

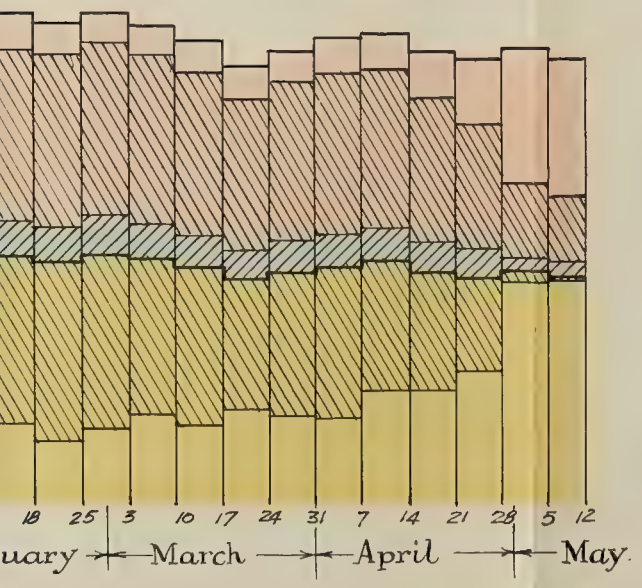
BREAKDOWN:

VALUE OF LAKE MINNEWANKA STORAGE THROUGH CASCADE AND BOW PLANTS PLUS KANANASKIS UPPER LAKE'S STORAGE THROUGH BARRIER & BOW PLANTS.	111 × 10^6 KW. HRS
VALUE OF SPRAY STORAGE THROUGH SPRAY PLANTS.	135 × 10^6 KW. HRS
OTHER ENERGY THROUGH SPRAY PLANTS.	100 × 10^6 KW. HRS
VALUE OF SPRAY STORAGE THROUGH BOW PLANTS.	27 × 10^6 KW. HRS
SECONDARY ENERGY AT BOW PLANTS FIRMED UP INTO PRIMARY ENERGY BY ADDITION OF SPRAY STORAGE AND PLANTS	73 × 10^6 KW. HRS

NOTE: BOW PLANTS:- HORSESHOE, KANANASKIS AND GHOST.
SPRAY PLANTS:- SPRAY, THREE SISTERS AND RUNDLE.

AND.- 685 × 10^6 KWH.

'B' - C.P. ANNUAL LOAD DEMAND · 350 × 10^6 KWH.



Calgary Power Limited.

KWH. VALUE OF SPRAY DEVELOPMENT. IN CALGARY POWER SYSTEM.

DEC. 1, 1951.

DRAWING: Nº C.P. 3396.

RURAL ELECTRIFICATION *in the* PROVINCE OF ALBERTA

(AS AT MARCH 1st, 1952)

CALGARY POWER LTD. — Through Its Subsidiary FARM ELECTRIC SERVICES LTD.

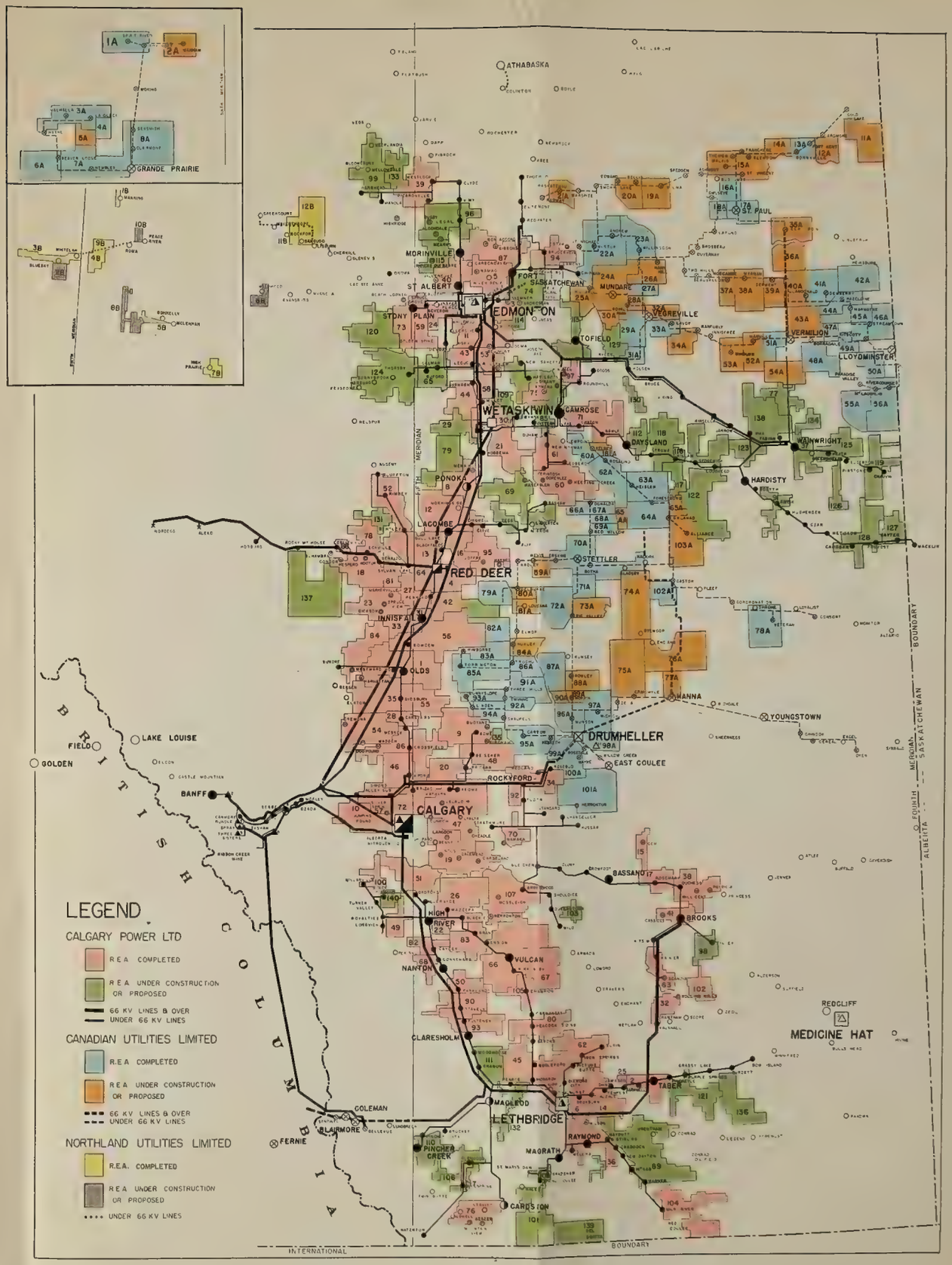
1 Olds
2 Taber
3 Bremner
4 Red Deer
5 Sturgeon
6 Lethbridge
7 Glenwood—Hillspring
8 Ponoka
9 Acme
10 Springbank
11 Strathcona
12 Fairview
13 Blackfalds
14 Coaldale
15 Gem
16 Lacombe
17 Rosemary
18 Eckville
19 Bow North
20 Irricana
21 Angus Ridge
22 Frank Lake
23 Markerville
24 Winterburn
25 Cranford
26 Gladys
27 Ridgewood
28 Carstairs
29 West Wetaskiwin
30 Wang
31 Big Bend
32 Vauxhall
33 Little Red Deer
34 Rosebud
35 West Didsbury
36 Raymond
37 Wainwright
38 One Tree
39 Wabash
40 Ray
41 Cassils
42 Penhold
43 Leduc West
44 West Liberty
45 Park Lake
46 West Airdrie
47 Lyalta
48 Beiseker
49 Longview
50 Parkland
51 Okotoks-DeWinton
52 Blindman Valley
53 Clearwater
54 Cremona
55 Mountain View
56 Bowden No. 1 & No. 2
57 Foothills
58 Fredricksheim
59 Spruce Grove
60 Evergreen
61 Battle River
62 Turin-Iron Springs
63 Bow Slope
64 Red Deer West
65 Neutral
66 Vulcan
67 Harmony
68 Connemara
69 Waterglen
70 Namaka
71 Hampton
72 Balzac
73 Stony Plain
74 Fort
75 Armena
76 Chief Mountain
77 Auburndale
78 Gilbey
79 Usona
80 Barons
81 Sylvan
82 Cayley
83 Brant
84 Bowden No. 3
85 Ervic
86 Crossfield
87 Gibbons-Bon Accord
88 Leslieville
89 Warner
90 Stavely
91 Amisk
92 Rockyford
93 Pulteney
94 Bruderheim
95 Clive
96 Legal
97 Kingman
98 Tilley
99 V.N.M.
100 Millarville
101 Boundary
102 Rolling Hills
103 Milo
104 Border
105 Fire Guard
106 United
107 Mossleigh
108 St. Mary's
109 Central Community
110 Chipman Creek
111 Hollandale
112 Daysland
113 Tofield
114 Ardrossan
115 Mearns
116 North Killam
117 South Killam
118 Strome
119 Chauvin
120 Duffield
121 Hudson
122 Sedgewick
123 Gratton
124 Strawberry
125 North Edgerton
126 South Edgerton
127 Hayter
128 Provost
129 Ryley
130 Holden
131 Lockhart
132 Ortton
133 Lynaria
134 White Cloud
135 Grainger
136 Burdett
137 Rocky Mtn. House
138 Roseberry
139 DelBonita
140 Black Diamond

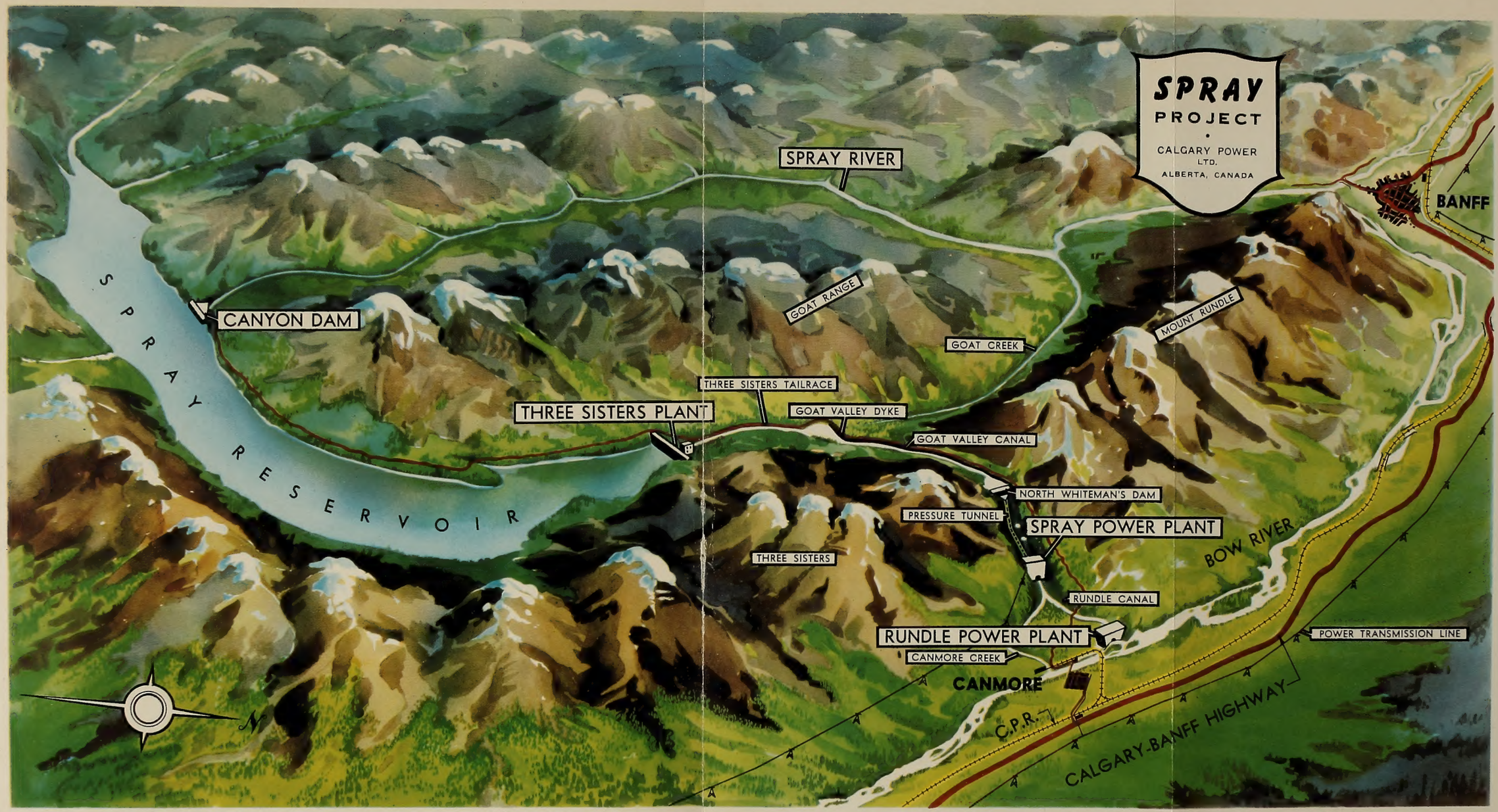
CANADIAN UTILITIES LIMITED

1A Spirit River
2A Wanham
3A Valhalla Center
4A Pioneer
5A Scenic Heights
6A Beaver Lodge South
7A Grande Prairie Individuals
8A Grande Prairie East
9A
10A
11A Grand Center
12A Ardmore
13A Bonnyville
14A Dupre
15A Mallaig
16A St.Vincent
17A St. Paul
18A Owlseye
19A Stry
20A Wahstao
21A Waskatenau
22A Zawale
23A Willingdon
24A Mundare-Hilliard
25A Ross Creek
26A Hairy Hill
27A Warwick
28A Brodie
29A Inland
30A Beaverhill Lake
31A Martins
32A Brush Hill
33A Lavoy
34A Ranfurly
35A Elk Point (North)
36A Elk Point (South)
37A Beauvallon
38A Myrnam
39A Derwent
40A Greenlawn Ext.
41A Greenlawn
42A Lea Park
43A Campbell Lake
44A Hazeldine
45A Bellcamp
46A Durness
47A Islay
48A Borradaile
49A Kitscoty
50A Devonia
51A Clasmore
52A Ottawa
53A Minburn
54A Auburndale
55A Paradise Valley
56A Merton
57A
58A
59A Nevis
60A Kelsey
61A Kelsey Ext.
62A Melrose
63A Sterling
64A Forestburg
65A Forestburg Ext.
65AA Forestburg Ext.
66A Up-to-Date
67A Spruce Coulee
68A Science Mound
69A Red Willow
70A Stettler
71A Sabine
72A Fenn
73A Zenith
74A Endiang North
75A Craigmyle
76A Scapa
77A Hanna
78A Veteran
79A Delburne West
80A Delburne
81A Lousana
82A Elnora
83A Huxley West
84A Huxley Ext.
85A Torrington
86A East Trochu
87A Rowley
88A Rowley Ext. (1952)
89A East Rowley Ext.
90A West Rowley Ext.
91A Ghost Pine
92A Twining
93A Sunnyslope
94A Swalwell
95A Carbon
96A Munson
97A Michichi
98A C.L.V.
99A Over the Hill
100A Wayne
101A Wintering Hills
102A Castor
103A Alliance

NORTHLAND UTILITIES LIMITED

1B Manning
2B Burnt River
3B Vanreno
4B White Swan
5B McLennan-Girouxville
6B Wildwood
7B High Prairie
8B Jean Cote
9B Kirndale
10B Stewart
11B Rochfort Bridge
12B Saddle Valley




SPRAY
PROJECT
CALGARY POWER
LTD.
ALBERTA, CANADA
SPRAY RIVER
BANFF
CANYON DAM
SPRAY
RESERVOIR
GOAT RANGE
MOUNT RUNDLE
GOAT CREEK
THREE SISTERS TAILRACE
THREE SISTERS PLANT
GOAT VALLEY DYKE
GOAT VALLEY CANAL
NORTH WHITEMAN'S DAM
PRESSURE TUNNEL
SPRAY POWER PLANT
THREE SISTERS
BOW RIVER
RUNDLE CANAL
RUNDLE POWER PLANT
POWER TRANSMISSION LINE
CANMORE CREEK
CANMORE
C.P.R.
CALGARY-BANFF HIGHWAY
N